

2.2 limits involving infinity

asymptotes — vertical p72
— horizontal p70

vertical

$$\lim_{x \rightarrow 0^+} \frac{1}{x} = \infty$$

$$\lim_{x \rightarrow 0^-} \frac{1}{x} = -\infty$$

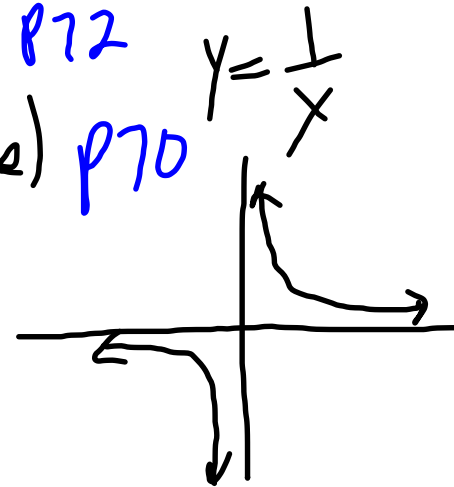
horiz

$$\lim_{x \rightarrow \infty} \frac{1}{x} = 0$$

$$\lim_{x \rightarrow -\infty} \frac{1}{x} = 0$$

VA: $x=0$

HA $y=0$



find the horiz & vert asymptotes
for $y = \frac{2x+1}{x} = 2 + \frac{1}{x}$ do algebraically

HA $y=2$

VA $x=0$

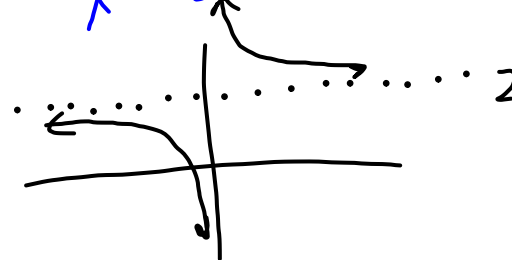
coeff. of x

~~\div by 0~~

$$\lim_{x \rightarrow 0^+} 2 + \frac{1}{x} = \infty$$

$$\lim_{x \rightarrow 0^-} 2 + \frac{1}{x} = -\infty$$

$$\lim_{x \rightarrow \infty} \frac{2x+1}{x} = \lim_{x \rightarrow \infty} 2 + \frac{1}{x} = 2$$

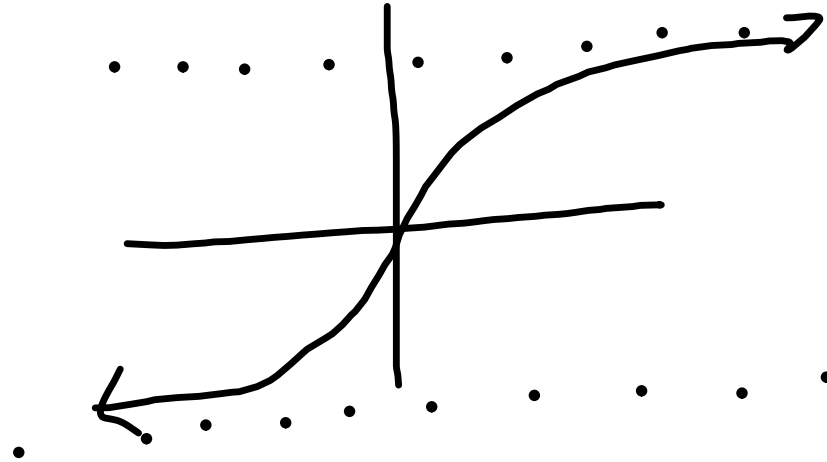


$$y = \frac{x}{\sqrt{x^2 + 1}}$$

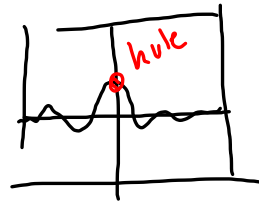
$$y = -1$$

$$y = 1$$

graph #A?



$$y = \frac{\sin x}{x}$$



$$\lim_{x \rightarrow 0} \frac{\sin x}{x} = 1$$

no VA

asymptotes?
do graphically

$$\cos x < \frac{\sin x}{x} \leq 1$$

$$\lim_{x \rightarrow 0} \cos x = 1$$

HA? $\lim_{x \rightarrow \infty} \frac{\sin x}{x} = 0$

mult by
 $\frac{1}{x}$

$$-1 \leq \sin x \leq 1$$

$$-\frac{1}{x} \leq \frac{\sin x}{x} \leq \frac{1}{x}$$

$$\lim_{x \rightarrow \infty} \frac{\sin x}{x} = 0$$

HA $y=0$

end behavior models

$$y = \frac{3x^4 - 2x^3 + 3x^2 - 5x + 6}{3x^4} = \infty$$

↗ 6

↘ ∞

VA $x = 0$

as
 $x \rightarrow 0$

HA $\lim_{x \rightarrow \infty} y = 1$

ebm $\frac{3x^4}{3x^4}$

and

$\lim_{x \rightarrow -\infty} y = 1$

HA $y = 1$

Ex 7 a

$$f(x) = \frac{2x^5 + x^4 - x^2 + 1}{3x^2 - 5x + 7}.$$

ebm:

$$y = \frac{2x^5}{3x^2} = \frac{2}{3}x^3$$

when you zoom way out
 $f(x)$ looks like $\frac{2}{3}x^3$